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EFFECT OF WINTER RATIONS ON GAINS OF CALVES MARKETED AS 3-YEAR-OLD STEERS

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THE APPALACHIAN REGION AND ITS PROBLEMS

The work reported in this bulletin is part of a series of experiments on beef-production problems in the Appalachian Mountain region that have been in progress since December 22, 1914, in cooperation between the Bureau of Animal Industry of the United States Department of Agriculture and the West Virginia Agricultural Experiment Station, on the farm of David Tuckwiller, in Greenbrier County, W. Va. This farm is situated in the southeastern part of the State, in the bluegrass area. The results of this experiment apply not only to West Virginia, but also the adjacent States having similar conditions, as shown in Figure 1. Some of the methods and results may be utilized to advantage by cattle feeders in other parts of the country.

The topography of most of this region is mountainous. Practically all the region is suitable for grazing. There are a great many valleys and plateaus where the land varies from almost level to gently rolling. Such land is well adapted for pasture and the production of cultivated crops. Though the region for the most part is cleared of virgin forest, there are still large areas of cut-over land. The farms vary in size from less than 100 to more than 1,000 acres. On most farms there is sufficient tillable land for the production of winter feed. Relatively little surplus grain is produced.

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[1] Acknowledgment is made of the services of C. V. Wilson, of the West Virginia Agricultural Experiment Station.

Most of the grass-fattened cattle which go annually to eastern markets are produced in this region. The fact that most of them are finished for market on grass alone attests the value of the pastures, which consist largely of blue grass. The use of grain for finishing cattle is not general, although there are many sections where the practice is followed, particularly in the valleys of some of the larger streams. By far the greater number of farmers who handle beef cattle either grow stockers and feeders or finish cattle for market from grass alone. Therefore, one of the principal beef-production problems is to determine the best and most economical method of wintering the cattle and the one that will enable them to make the best possible use of the pasture the following summer, when the cheapest gains are made. A common practice in this area has been to winter steers on dry feed, such as hay, corn stover, and wheat straw, and on corn silage to a less extent, in such way that they lose materially in weight. They are then pastured the following summer and sold from grass as stockers, feeders, or finished steers. There are some who hold that it is profitable to permit this loss of weight, which with older steers usually varies from 25 to 100 pounds. Others believe that cattle wintered on silage, or on a ration of which silage is a part, will not do well on grass the following summer.

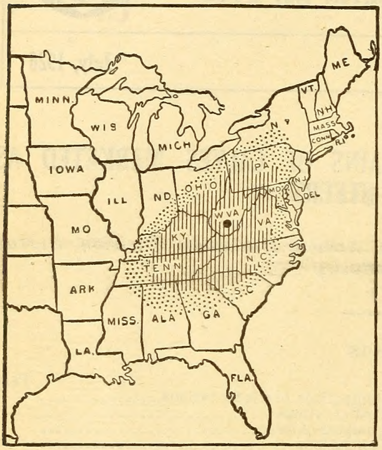

FIG. 1.—Map showing region to which this work applies. The black dot indicates the location of the farm on which the experiment was conducted. The shaded portion represents the area to which the results are applicable, and the dotted portion shows an additional area to which the results apply in part

OBJECTS AND PLAN OF THE WORK

The experiments as a whole had the following general problems in view:

To ascertain the effect of different wintering rations on subsequent pasture gains.

To determine the most satisfactory and economical method of wintering.

To determine the best method and the cost of raising beef cattle in West Virginia.

The results of previous work with cows, calves, yearlings, and 2-year-olds are published in United States Department of Agriculture Bulletins 870, 1024, 1042, and 1251, respectively. In all the previous work the cattle were kept one year only.

This bulletin is a report of the work with calves kept from weaning age until marketed as 3-year-old steers.

The objects of this experiment were:

1. To study the effects of the following winter rations fed to calves upon their subsequent gains on pasture and until they are marketed as grass-fat 3-year-olds.

Ration I	*Ration II*	*Ration III*
Clover hay.	Cottonseed meal.	Mixed hay.
Corn silage.	Corn silage.	Grain mixture.
Wheat straw.	Wheat straw.	

2. To study the effects of the following rations fed to the same calves as yearlings, upon their subsequent gains until they are marketed as grass-fat 3-year-olds.

Ration I	*Ration II*	*Ration III*
Clover hay.	Cottonseed meal.	Mixed hay.
Corn silage.	Corn silage.	Corn silage.
Wheat straw.	Wheat straw.	Wheat straw.

The three lots of yearlings fed during the winter of 1923-24 were each made up of 10 steers from each of the lots of the year preceding.

3. To obtain a continuous feed and growth record for steers from the weaning age until they are fattened on grass as 3-year-old steers.

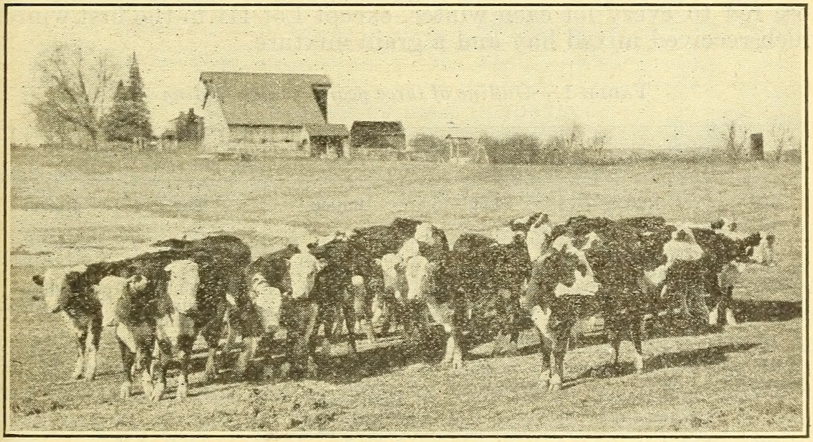

FIG. 2.—Calves at beginning of experiment, December 22, 1922

KIND OF STEERS USED

For use in this experiment 100 good to choice Hereford steer calves were obtained in north central Texas. They arrived at the farm about the end of November, 1922, having been in transit from Texas 18 days and showing to a marked degree the effects of the long journey and insufficient feed. On December 22, when the feeding started, the calves averaged 386 pounds in weight, ranging from 300 to 500 pounds. (See fig. 2.)

METHOD OF FEEDING AND HANDLING THE STEERS

For the experimental feeding 90 of the calves were selected and divided into three lots of 30 each. In making this division care was taken to have the lots as nearly uniform as possible in quality, size, and condition. The three lots were each given the same amount of space in an open barn and were kept under cover all winter. The steers were fed twice a day, and the feed, both concentrates and roughage, was carefully weighed at each feeding. Water was supplied in the barn at all times and salt was constantly available.

The steers were weighed individually three days in succession at the beginning and at the end of the winter feeding period, and averages taken for their initial and final weights. They were also weighed once every 28 days, in the morning after feeding. Numbered ear tags were used, so that ready identification of each individual could be made and records accurately kept.

In the spring of each year, as soon as the grass was good enough, which was usually about April 25, the steers from all the lots were turned into the same or similar pastures with no additional feed. Weights were taken once every 28 days during the first two summers. During the last summer, weights were taken only once, July 22, before the final weight on September 10, when they were marketed.

One steer was struck by lightning on June 6, 1925, this being the only animal lost in the three years.

The outline in Table 1 shows how the steers were fed each winter until they were fattened on grass as 3-year-olds. Only the feeds to be compared are put into the diagram. Corn silage and wheat straw were fed to every lot each winter, except Lot III in the first winter, which received mixed hay and a grain mixture.

TABLE 1.—*Outline of three years' winter feeding*

1922–23		1923–24		1924–25	
Lot	Ration	Lot	Ration	Lot	Ration
I (30 calves.)	Clover hay. Corn silage. Wheat straw.	A (30 yearlings. 10 each from Lots I, II, and III of preceding winter.)	Clover hay. Corn silage. Wheat straw.	(90 head 2-year-olds. Lots A, B, and C of preceding winter combined.)	Cottonseed meal. Corn silage. Wheat straw.
II (30 calves.)	Cottonseed meal. Corn silage. Wheat straw.	B (Same as A.)	Cottonseed meal. Corn silage. Wheat straw.		
III (30 calves.)	Mixed hay. Grain mixture.[1]	C (Same as A.)	Mixed hay. Corn silage. Wheat straw.		

[1] Consisted of 3 parts, by weight, of corn, 1 of bran, and 1 of linseed meal.

QUANTITY OF FEED CONSUMED AND GAINS MADE

Table 2 shows the total quantity of the different feeds consumed by the various lots and the average daily ration per steer in each lot during each of the three winters. All lots were fed to gain in weight during the winter.

TABLE 2.—*Average total and daily rations and gains per steer during the three winters*

WINTER OF 1922-23 (124 DAYS)

Lot	Winter feed	Total feed per steer	Daily feed per steer	Average initial weight per steer	Average weight per steer at end of winter	Total gain per steer
		Pounds	*Pounds*	*Pounds*	*Pounds*	*Pounds*
I	Clover hay	400.0	3.2	388	446	58
	Corn silage	1,528.5	12.3			
	Wheat straw	124.0	1.0			
II	Cottonseed meal	92.2	.7	383	462	79
	Corn silage	1,528.5	12.3			
	Wheat straw	412.5	3.3			
III	Mixed hay	1,240.0	10.0	389	502	113
	Grain mixture [1]	368.5	3.0			
WINTER OF 1923-24 (120 DAYS)						
A	Clover hay	603.0	5.0	575	662	87
	Corn silage	2,166.0	18.0			
	Wheat straw	242.0	2.0			
B	Cottonseed meal	120.0	1.0	576	655	79
	Corn silage	2,166.0	18.0			
	Wheat straw	603.0	5.0			
C	Mixed hay	603.0	5.0	575	615	40
	Corn silage	2,166.0	18.0			
	Wheat straw	242.0	2.0			
WINTER OF 1924-25 (126 DAYS)						
All 3 lots the same.	Cottonseed meal	135.2	1.1	905	940	35
	Corn silage	3,272.0	26.0			
	Wheat straw	607.5	4.8			

[1] Consisted of 3 parts, by weight, of corn, 1 of bran, and 1 of linseed meal.

At the beginning of the second winter feeding period, December 17, 1923, three new lots were made by taking 10 steers from each of the three original lots, and these are hereafter designated as Lots A, B, and C. The purpose was to offset the effects of the rations fed the first winter and to make it possible to get a fair and direct comparison of rations fed the second winter. In order to study more in detail the effects of the winter ration on subsequent gains the second winter and thereafter, each 10 steers from the original Lots I, II, and III of the first winter were numbered A_1, A_2, A_3, B_1, B_2, B_3, and C_1, C_2, C_3. The letters designate each lot of 10 steers, and the numerals indicate the source from which they came. For example, the numeral 1 identifies the 10 head taken from the original Lot I. By referring to Table 2 it is seen that Lot A was fed clover hay, corn silage, and wheat straw the winter of 1923-24 (second winter), and that Lot I also received the same feeds the first winter. A_1, then, identifies 10 head of steers fed the first winter on clover hay, corn silage, and wheat straw, and the second winter on the same ration. C_3 designates the 10 head fed during the winter of 1923-24 on mixed hay, silage, and wheat straw, and the winter previous on mixed hay and grain mixture, and so on. The gains made by the steers on pasture during the summer periods are shown in Table 3.

TABLE 3.—*Average total and daily gains per steer on pasture during the three summer periods*

Year and days on pasture	Lot	Initial weight, beginning of summer	Final weight, end of summer	Total gain	Daily gain
		Pounds	*Pounds*	*Pounds*	*Pounds*
1923 (236 days)	I	446	573	127	0.54
	II	462	581	119	.50
	III	502	601	99	.42
1924 (241 days)	A	662	898	236	.98
	B	655	916	261	1.08
	C	615	900	285	1.18
1925 (141 days)	All combined	940	1,259	319	2.26

Reference to Table 2 shows that during the first winter Lot I gained 58 pounds, Lot II 79 pounds, and Lot III 113 pounds. During the following summer (Table 3), Lot I gained 127 pounds, Lot II 119 pounds, and Lot III 99 pounds per steer.

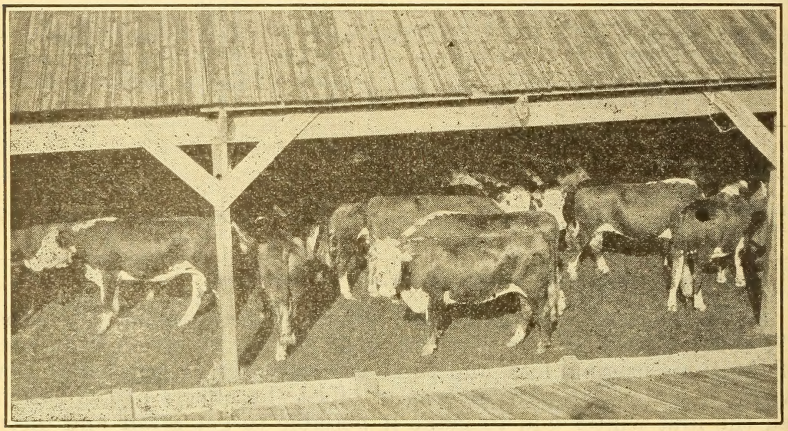

FIG. 3.—Three-year-old steers on arrival at Jersey City market, September, 1925, at close of experiment

During the second winter Lot A gained 87 pounds, Lot B 79 pounds, and Lot C 40 pounds. In the second summer Lot A gained 236 pounds, Lot B 261 pounds, and Lot C 285 pounds.

These data show that when the cattle are turned on grass in the summer (without additional feed) the lots which gain heavily during the previous winter do not gain so much in the following summer, and that the lots gaining least in winter make relatively large summer gains.

COMPARISONS OF WINTER RATIONS

In order to make a more complete study of the effect of different winter rations from year to year on grass-fat steers ultimately produced, Table 4 was prepared.

TABLE 4.—*Average weights of steers at beginning and end of each winter period*

Lots and rations	December, 1922	April, 1923	December, 1923	April, 1924	December, 1924	April, 1925	September, 1925	Total gain (988 days)
	Pounds	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*
A_1, 10 steers from Lot I, fed clover hay, silage, and straw first winter	385	442	555	652	874	900	1,200	815
A_2, 10 steers from Lot II, fed cottonseed meal, silage, and straw first winter	371	447	562	635	879	919	1,213	842
A_3, 10 steers from Lot III, fed mixed hay and grain mixture first winter	398	515	609	698	940	969	1,302	904
Above fed clover hay, silage, and straw second winter.								
B_1, 10 steers from Lot I	374	432	542	615	858	902	1,202	828
B_2, 10 steers as above	391	476	589	680	947	999	1,268	877
B_3, 10 steers as above	379	488	599	671	942	965	1,291	912
Above fed cottonseed meal, silage, and straw second winter.								
C_1, as above	404	465	592	632	927	960	1,307	903
C_2, as above	387	463	561	607	886	933	1,284	897
C_3, as above	390	502	572	608	891	919	1,259	869
Above fed mixed hay, corn silage, and wheat straw second winter.								

Since all 90 head were fed the same ration during the third winter, as noted before, Table 5 comparing the first two years follows:

TABLE 5.—*Comparison of winter and summer gains, first two years of experiment*

Lot	First year				Second year				Third year
	Winter		Summer	Total gain	Winter		Summer	Total gain	Total winter and summer gain
	Ration	Gain	Gain on pasture		Ration	Gain	Gain on pasture		
		Lbs.	*Lbs.*	*Lbs.*		*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
A_1	Clover hay, silage, and straw.	57	113	170	Clover hay, silage, and straw.	97	222	319	326
A_2	Cottonseed meal, silage, and straw.	76	115	191	do	73	244	317	334
A_3	Mixed hay and grain mixture.	117	94	211	do	89	242	331	362
B_1	Clover hay, silage, and straw.	58	110	168	Cottonseed meal, silage, and straw.	73	243	316	344
B_2	Cottonseed meal, silage, and straw.	85	113	198	do	91	267	358	321
B_3	Mixed hay and grain mixture.	109	111	220	do	72	271	343	349
C_1	Clover hay, silage, and straw.	61	127	188	Mixed hay, silage, and straw.	40	295	335	380
C_2	Cottonseed meal, silage, and straw.	76	98	174	do	46	279	325	398
C_3	Mixed hay and grain mixture.	112	70	182	do	36	283	319	368

Groups A_1, B_1, and C_1 were fed as Lot I the first winter.
Groups A_2, B_2, and C_2 were fed as Lot II the first winter.
Groups A_3, B_3, and C_3 were fed as Lot III the first winter.
During the second winter all A groups constituted Lot I, B groups Lot II, and C groups Lot III.

COST OF RATIONS

To figure the cost of wintering and summering the steers (Table 6) it becomes necessary to fix the prices for feeds used in the experiment. On account of fluctuations of the market, and also for simplicity in making the various calculations, an approximation of the local market feed prices per ton and pasture per day for the three years is used, as follows:

Corn silage	$6.00
Cottonseed meal	50.00
Mixed hay	18.00
Clover hay	17.00
Wheat straw	7.00
Grain mixture [1]	39.76
Pasture per day:	
Yearlings	.03
2-year-olds	.05
3-year-olds	.10

TABLE 6.—*Cost per steer of winter feed and summer pasture, and cost per pound of total gain*

Lot	Total gain per steer, 3 years	Cost of feed per steer							Cost of feed per pound of gain
		Winter 1922–23	Summer 1923	Winter 1923–24	Summer 1924	Winter 1924–25	Summer 1925	Total	
	Pounds								*Cents*
A_1	815	$8.42	$7.08	$12.48	$12.05	$15.33	$14.10	$69.46	8.5
A_2	842	8.34	7.08	12.48	12.05	15.33	14.10	69.38	8.2
A_3	904	18.49	7.08	12.48	12.05	15.33	14.10	79.53	8.8
B_1	828	8.42	7.08	11.61	12.05	15.33	14.10	68.59	8.3
B_2	877	8.34	7.08	11.61	12.05	15.33	14.10	68.51	7.8
B_3	912	18.49	7.08	11.61	12.05	15.33	14.10	78.66	8.6
C_1	903	8.42	7.08	12.78	12.05	15.33	14.10	69.76	7.7
C_2	897	8.34	7.08	12.78	12.05	15.33	14.10	69.68	7.8
C_3	869	18.49	7.08	12.78	12.05	15.33	14.10	79.83	9.2

The cost of the winter feed is considerably more than the cost of summer feed, yet the gain is made chiefly in summer.

ANALYSES OF FEEDS

The feeds used during the winter feeding in these experiments were analyzed by the West Virginia Agricultural Experiment Station. The analyses are shown in Table 7.

TABLE 7.—*Analyses of feeds*

Feed	Year	Water	Ash	Protein	Fiber	Nitrogen-free extract	Fat
		Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
Silage	1922–23	64.07	1.06	2.64	5.92	24.87	1.44
	1923–24	60.50	3.15	3.06	7.43	24.37	1.49
Clover hay	1922–23	5.60	4.77	8.81	40.70	38.32	1.80
	1923–24	6.34	5.20	9.61	34.14	42.55	2.16
Mixed hay	1922–23	5.90	4.96	8.64	35.54	42.75	2.21
	1923–24	5.10	4.04	6.14	31.51	50.58	2.63
Wheat straw	1922–23	4.87	4.03	4.48	41.66	43.68	1.28
	1923–24	5.08	3.49	4.08	42.27	43.44	1.64
Corn	1922–23	8.60	1.23	9.98	2.58	73.20	4.41
Linseed meal	1922–23	7.93	4.86	35.76	8.22	36.11	7.12
Cottonseed meal	1922–23	8.44	5.94	34.28	12.95	32.02	6.37
	1923–24	8.14	6.56	36.46	11.42	30.78	6.64
Bran	1922–23	7.91	6.60	15.76	10.61	53.64	5.48

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[1] Based on corn at 96 cents a bushel, wheat bran at $40 a ton, and linseed meal at $56 a ton.

CONCLUSIONS

From a study of the growth curves shown in Figures 4 and 5 it is plainly seen that a loss in weight during the last two months of the grazing periods occurred both in 1923 and in 1924. In other words, the average weight of the 90 steers on October 10, 1923, was practically the same as it was six months later, or April 18, 1924. This suggests a point worthy of more study and investigation. This loss of weight after frost comes in the fall and before putting the cattle into winter quarters should undoubtedly be avoided. The solution may lie either in supplementing this late fall pasture with grain or in placing the cattle into winter quarters earlier.

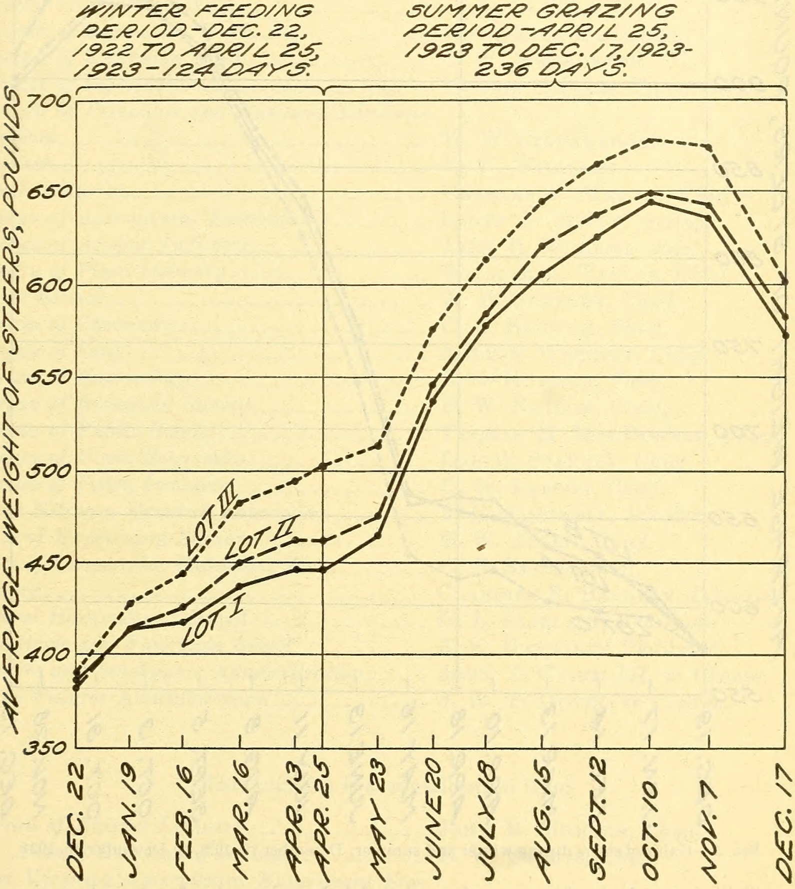

FIG. 4.—Gains of steers during winter and summer, December 22, 1922, to December 17, 1923

The steers which made only slight gains in weight during the winter made greater gains on pasture the following summer than steers which made larger winter gains.

Differences in gains made by steers during the winter owing to rations fed are gradually minimized during the time of summer fattening on grass. Consequently it is important that cattle to be marketed early from grass should gain considerably more weight during the winter than if they are to be marketed late.

There was little difference between the gains made by the steers in the different lots at the end of the summer grazing periods. Therefore the cost of a winter ration should be the chief consideration in determining the ration to be used when steers are to be finished on pasture.

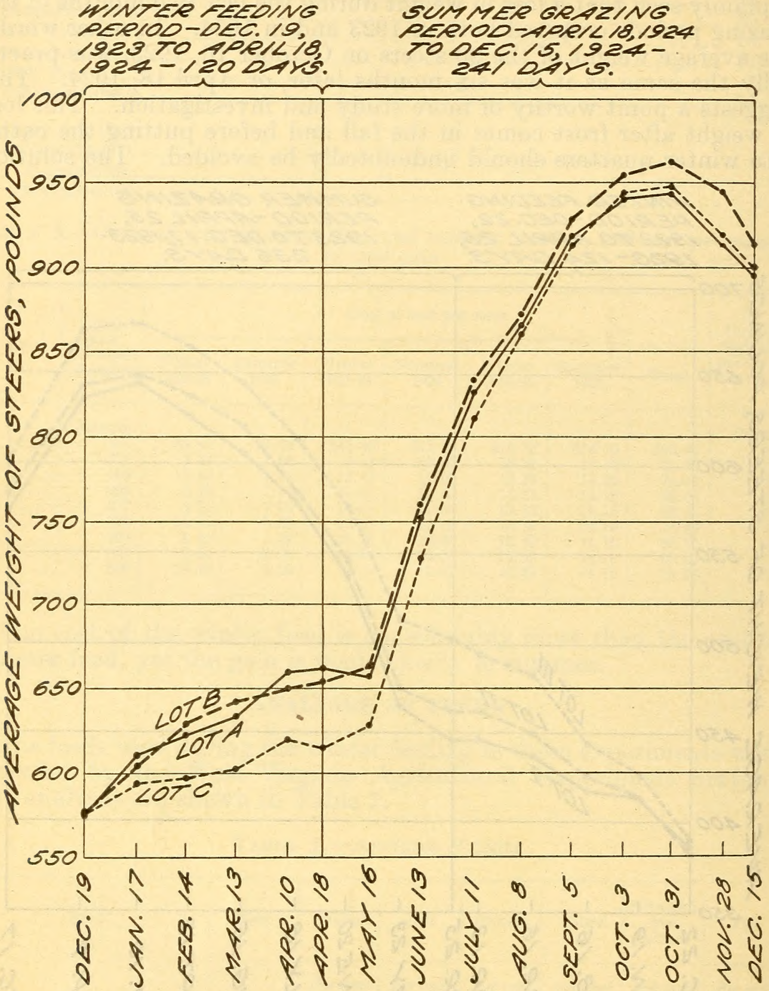

FIG. 5.—Gains of steers during winter and summer, December 19, 1923, to December 15, 1924

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June 19, 1926

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